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**F2D DCG D101 D113 D130 D132 D209 D250 D251**

(56) Documents Cited

**GB 2298907 A** **EP 0451887 A** **US 4976170 A**  
**US 4846019 A** **US 4507986 A**

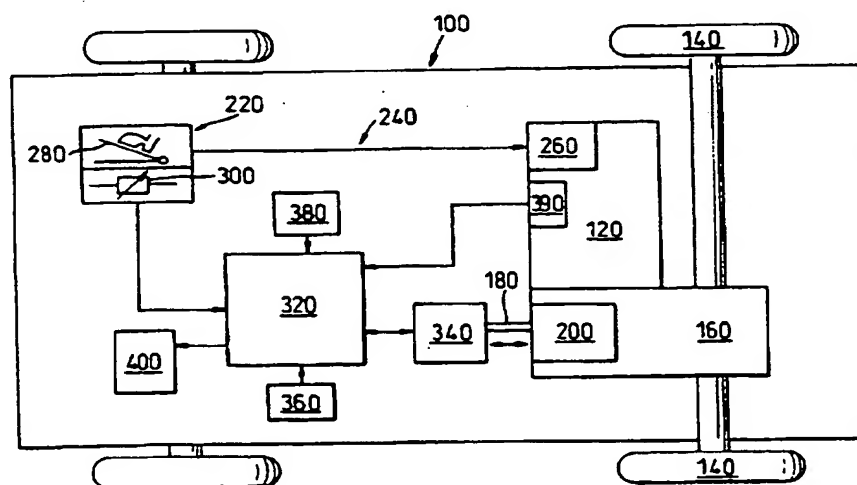
(58) Field of Search

**UK CL (Edition P) F2D DCG DDA DDB**  
**INT CL<sup>6</sup> B60K 41/12 41/14**

(54) Abstract Title

**Electrohydraulic control system for a continuously-variable transmission of a vehicle**

(57) A CVT control system for a vehicle 100 alters the ratio of the CVT 160 by the movement of a control pin 180 into and out of a hydraulic valve block 200. The movement of the pin 180 is effected by a stepper motor 340 under the control of a CVT controller 320. The CVT controller 320 receives a signal of accelerator pedal displacement and uses the stepper motor 340 to move the pin 180 into and out of the block 200 in accordance with a characteristic curve selected using an input switch 360 to provide a plurality of output characteristics such as: sport S, drive D and economy E.

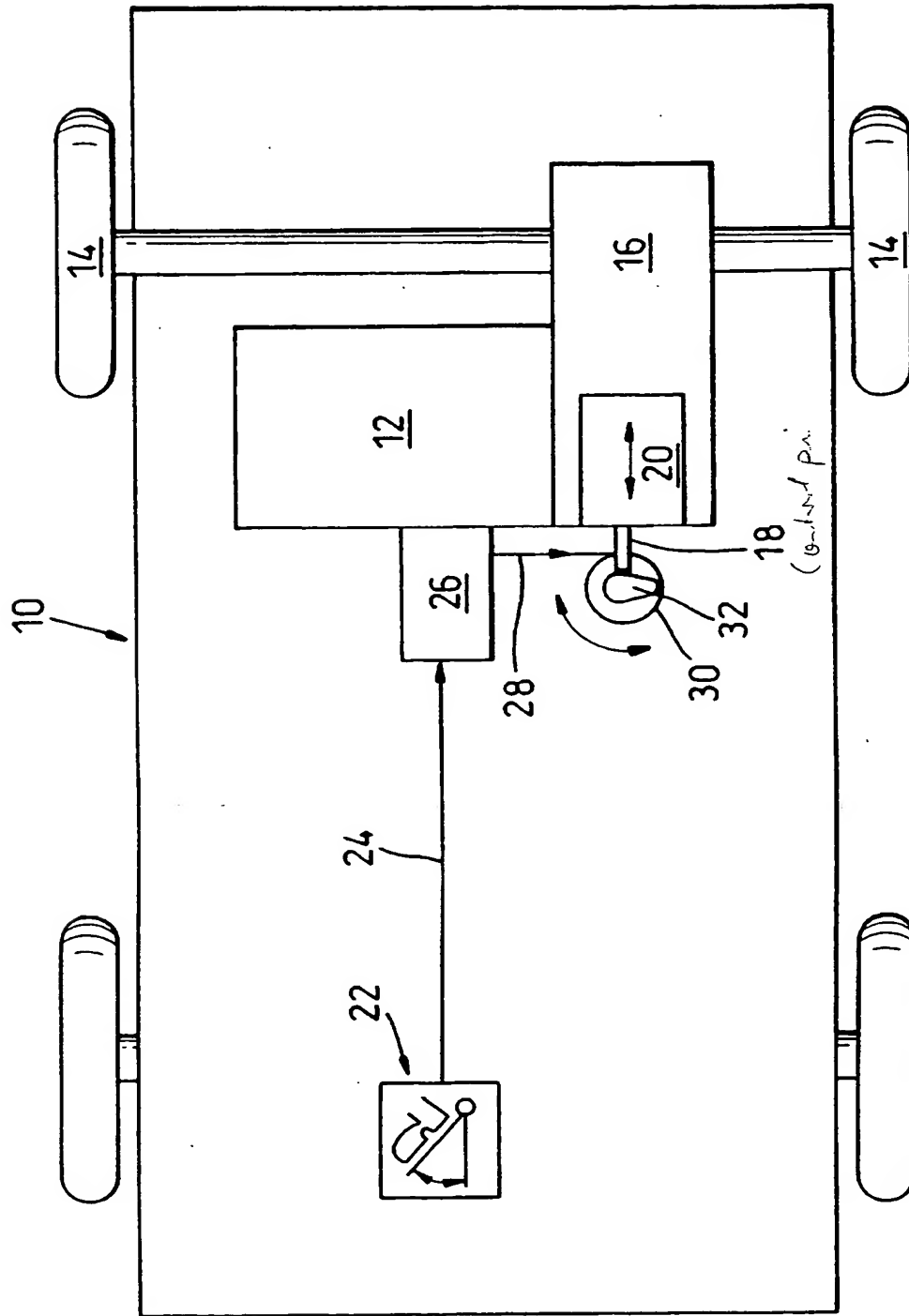


**Fig. 4**

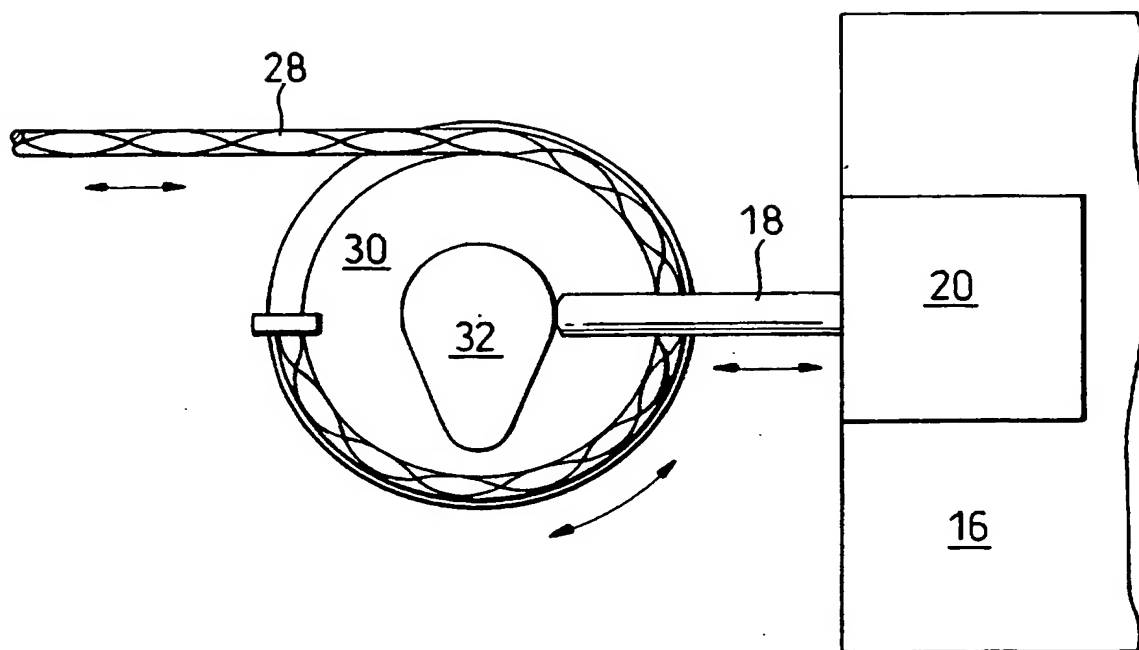
3 Modi S, D, E

Pin Abh. von u<sub>acc</sub>

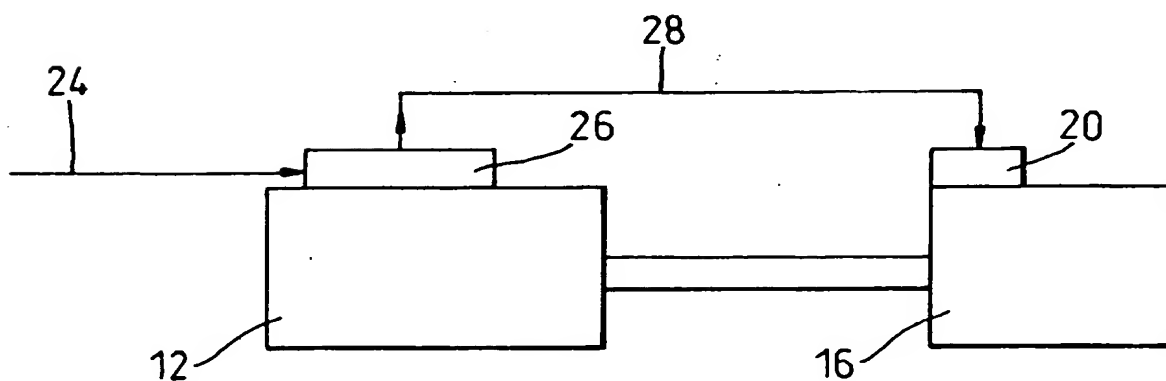
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**Fig. 1**  
(PRIOR ART)



***Fig. 2***  
(PRIOR ART)



***Fig. 3***  
(PRIOR ART)

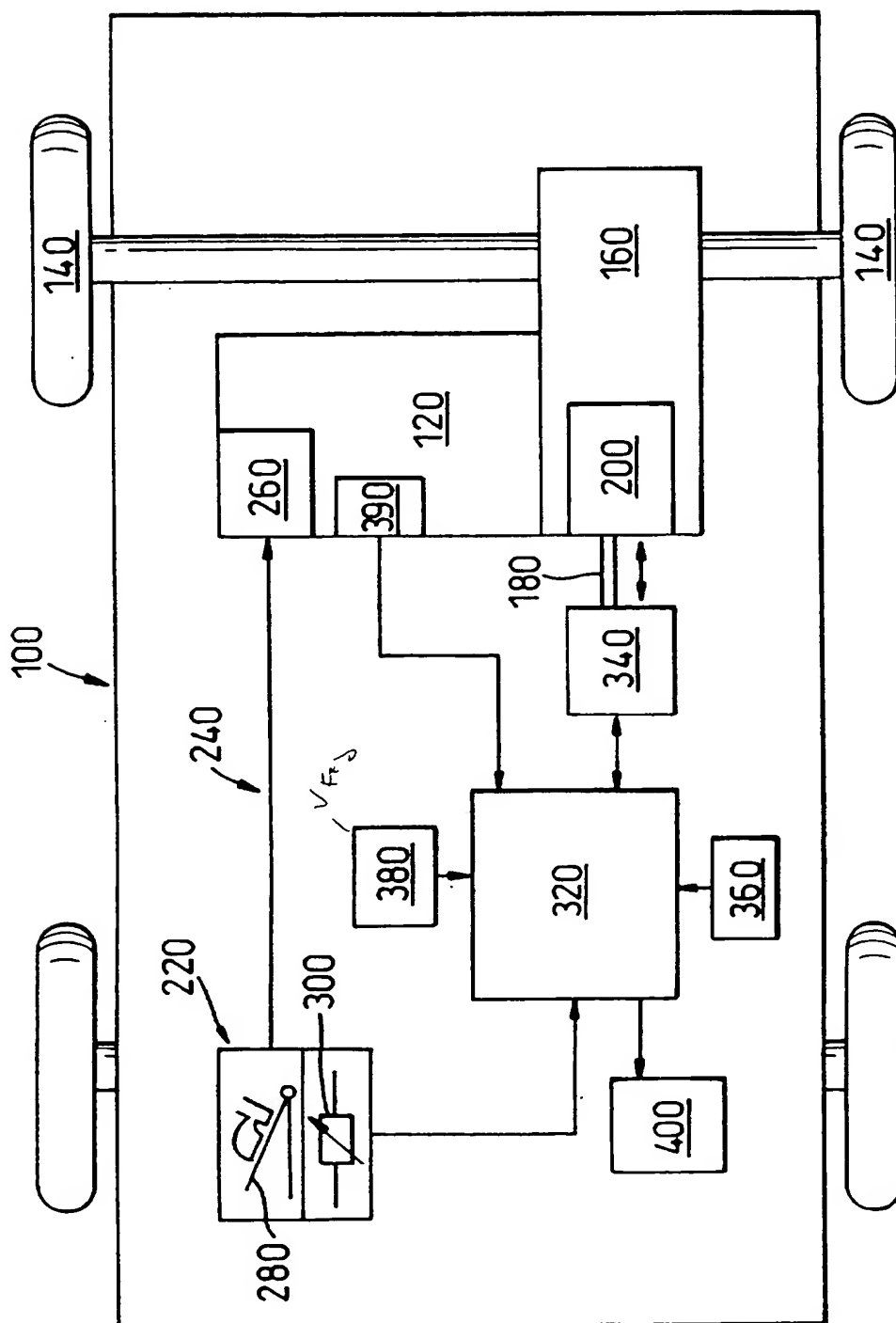
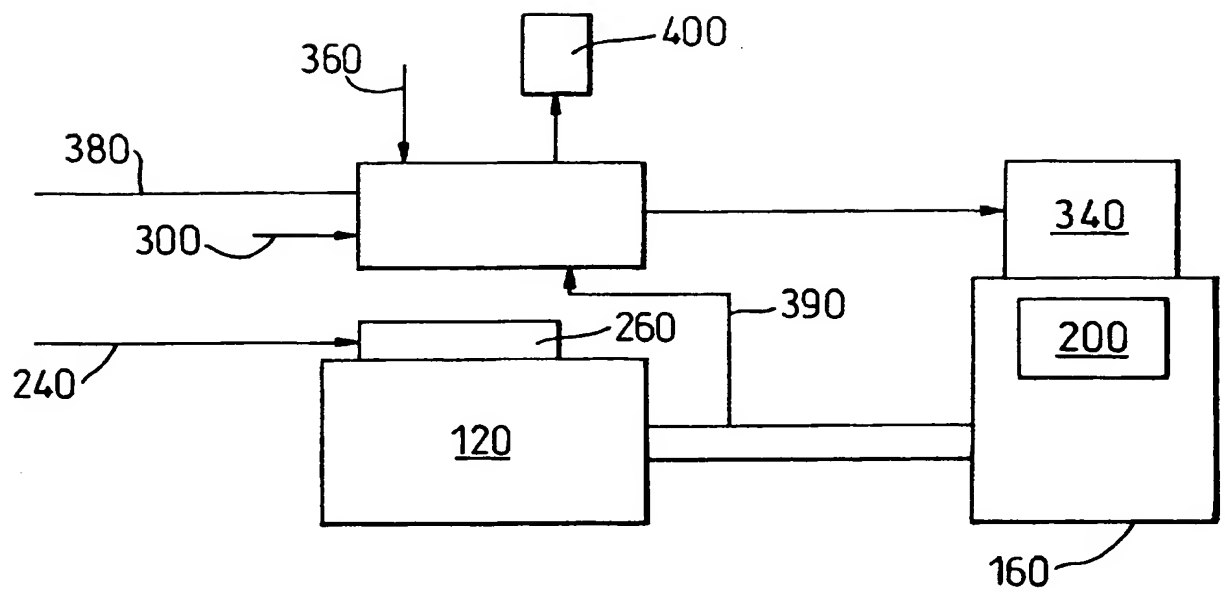
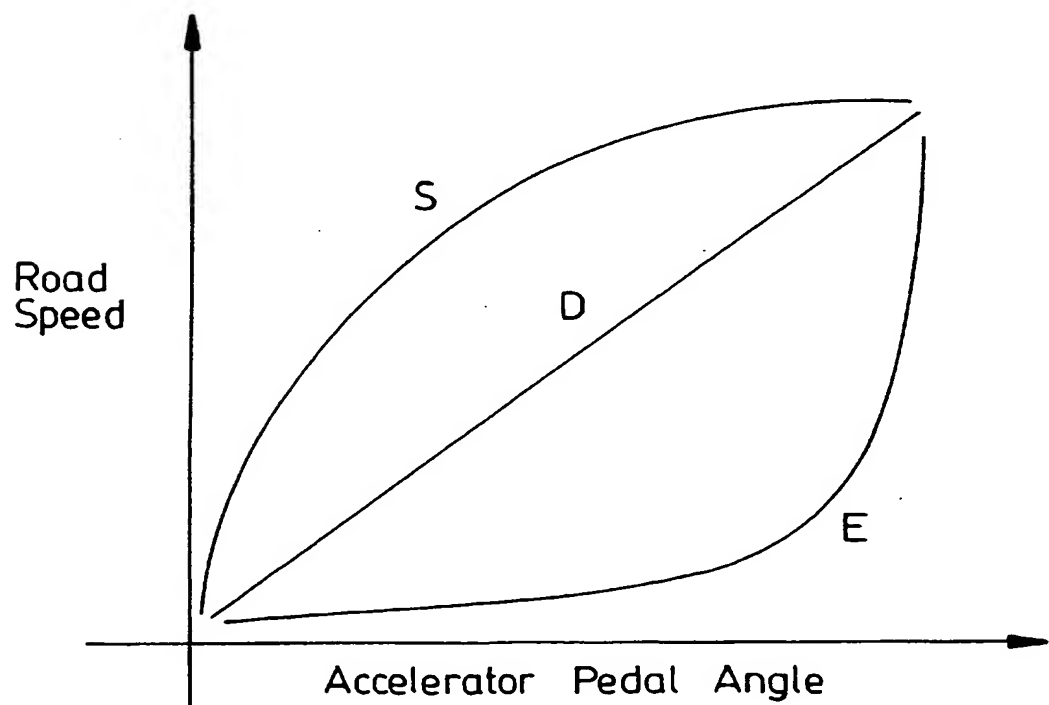


Fig. 4



**Fig. 5**



**Fig. 6**

A Transmission Control System for a Vehicle

This invention relates to transmission control systems and in particular to a transmission control system for a continuously variable transmission of a vehicle.

It is known to provide a vehicle with a transmission having an output  
5 ratio which can be varied in a continuous manner. It is common for such continuously variable transmissions to be controlled by a mechanical connection between the accelerator pedal and an output ratio varying mechanism forming part of the transmission.

It is an object of this invention to provide an improved transmission  
10 control system for a vehicle having a continuously variable transmission.

According to the invention there is provided a transmission control system for a vehicle comprising a means for varying the transmission ratio of a continuously variable transmission of the vehicle, a driver operated acceleration demand means for producing an acceleration demand signal,  
15 and a control means operative to control said varying means in response to said acceleration demand signal, wherein the varying means comprises a electrical actuator arranged to control the operation of an output ratio control member of said continuously variable transmission.

The control member may control the operation of a hydraulic valve block of the continuously variable transmission in order to vary the output ratio. The control member may comprise a control pin of the hydraulic valve block and the electrical actuator may comprise a linear electrical  
5 actuator arranged to displace said control pin across a range of linear movement. The electrical actuator may comprise a stepper motor.

The control means may be arranged to translate the acceleration demand signal into operation of said control member in a manner defined by a number of selectable control characteristics.

10 The invention also provides a vehicle having a transmission control system according to the invention.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is schematic diagram of a vehicle having a prior art  
15 transmission control system:

Figure 2 is a detailed view of part of the prior art system of Figure 1;

Figure 3 is a functional block diagram of the prior art transmission control system of Figure 1;

Figure 4 is a schematic diagram of a vehicle having a transmission control system according to the invention;

Figure 5 is a functional block diagram of the transmission control system of Figure 4; and

5        Figure 6 is a graphical representation of a set of control characteristics used by the system of Figures 4 and 5 to control the output ratio of the transmission.

Referring to Figures 1 to 3, a vehicle 10 has an engine 12 driving a set of wheels 14 through a continuously variable transmission (CVT) 16.

10        The output ratio of the CVT 16 is altered by the movement of a control pin 18 into and out of a hydraulic valve control block 20 forming part of the CVT 16.

A driver operated accelerator pedal assembly 22 has an accelerator cable 24 connecting it to a throttle butterfly 26 of the engine 12 and  
15        movement of the accelerator pedal (not shown separately) is converted into movement of the throttle butterfly 26 in a conventional manner.

A transmission control cable 28 is connected to, and displaced by, movement of the throttle butterfly 26. The control cable 28 is connected to a

pulley wheel 30 and when the cable 28 is displaced by the throttle butterfly 26, the cable 28 translates that displacement into rotation of the pulley wheel 30 in parallel to the movement of the butterfly 26. The pin 18 is biased towards a cam 32 which co-rotates with the pulley wheel 30. In this  
5 manner, an acceleration demand from the accelerator pedal is translated into movement of the throttle butterfly and a corresponding variation in the output ratio of the CVT 16 in parallel.

Such a prior art system is limited to a single output characteristic of the CVT 16, because the mechanical connection between the accelerator pedal  
10 assembly 22 and the cam 32 means that there is only one range of movement possible for the control pin 16.

The output characteristic is defined by the profile of the cam 32 and is used to vary the output ratio of the CVT 16 through the movement of the control pin 18 into and out of the valve block 20.

15 An improved transmission control system is now shown with reference to Figures 4 to 6. A vehicle 100 has an engine 120 driving a set of wheels 140 through a continuously variable transmission (CVT) 160.

The output ratio of the CVT 160 is controlled by the movement of a control pin 180 into and out of a hydraulic valve block 200 forming part of the CVT 160.

A driver operated accelerator pedal assembly 220 has an accelerator  
5 cable 240 connected to a throttle butterfly 260 of the engine 120 and movement of an accelerator pedal 280 is translated into movement of the throttle butterfly 260 in a conventional manner.

The accelerator pedal assembly 220 further comprises a potentiometer 300 arranged to detect the displacement of the accelerator pedal 280 and  
10 provide an acceleration demand signal indicative of the accelerator pedal angle to a CVT controller 320.

The CVT controller 320 electrically controls a stepper motor 340 which moves the pin 180 into and out of the valve block 200 to vary the output ratio of the CVT 160. The stepper motor 340 is controlled according to one  
15 of three control characteristics: sport S, drive D and economy E, which are shown with particular reference to Figure 6.

The control characteristics S, D, E are selected using an input to the CVT controller 320 from a three-way switch 360. The CVT controller 320

also has an input of road speed from a road speed sensor 380 and of engine speed from an engine speed sensor 390.

The CVT controller 320 outputs a signal on a display unit 400 indicative of which characteristic S, D, E is currently selected.

5 The mechanical isolation of the control pin 180 from the accelerator pedal 280 and the variation of the CVT output ratio by the CVT controller 320 operating the stepper motor 340, provides increased flexibility of CVT operation. The degree of movement of the pin 180 is defined by the characteristic selected, as described below.

10 In sport S, the pin 180 is displaced over a large proportion of its full range of movement over the initial range of movement of the accelerator pedal 280. The sports characteristic S provides a sharp increase in road speed for low initial angles of pedal movement.

In drive D, the pin 180 is displaced in a linear fashion over the full  
15 range of movement of the accelerator pedal 280 and provides a substantially linear increase in road speed.

In economy E, the pin is displaced by only a small proportion of its full range of movement over the initial range of movement of the accelerator

pedal 280. In order to reach high road speeds in economy mode E, the accelerator pedal 280 must be depressed by a much greater angle than in the other modes.

The three characteristic curves S, D, E converge towards their upper  
5 and lower limits to ensure that substantially the full range of road speed is available over the full range of movement of the accelerator pedal 280 in each mode.

The provision of a road speed signal and an engine speed signal to the CVT controller 320 enables it to operate the control of the output ratio  
10 under closed loop control, as these inputs allow the calculation of the instant output ratio.

CLAIMS

1. A transmission control system for a vehicle comprising a means for varying the transmission ratio of a continuously variable transmission of the vehicle, a driver operated acceleration demand means for producing an acceleration demand signal, and a control means operative to control said varying means in response to said acceleration demand signal, wherein the varying means comprises a electrical actuator arranged to control the operation of an output ratio control member of said continuously variable transmission.
2. A transmission control system according to Claim 1, wherein the control member controls the operation of a hydraulic valve block of the continuously variable transmission in order to vary the output ratio.
3. A transmission control system according to Claim 1 or Claim 2, the control member comprising a control pin of the hydraulic valve block and the electrical actuator comprising a linear electrical actuator arranged to displace said control pin across a range of linear movement.
4. A transmission control system according to any preceding claim, the electrical actuator comprising a stepper motor.

5. A transmission control system according to any preceding claim, wherein the control means is arranged to translate the acceleration demand signal into operation of said control member in a manner defined by a number of selectable control characteristics.
6. A transmission control system substantially as described herein with reference to Figures 4 to 6 of the accompanying drawings.
7. A vehicle having a transmission control system according to any preceding claim.



Application No: GB 9719849.3  
Claims searched: 1 - 5

Examiner: Tom Sutherland  
Date of search: 29 January 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.P): F2D (DDA, DDB, DCG)

Int CI (Ed.6): B60K 41/12, 41/14

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2298907 A (FUJI) See Fig. 2 and page 8 line 23.	1, 2, 3, 5
X	EP 0451887 A (VAN DOORNE) Note Fig. 5.	1, 2, 3, 5
X	US 4976170 (HONDA) See Figs 1 and 15 (motor 57)	1, 2, 4, 5
X	US 4846019 (NISSAN) See Figs 1A, 1B and 4.	1, 2, 4, 5
X	US 4507986 (NISSAN) See Fig. 3.	1, 2, 4, 5

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
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A Document indicating technological background and/or state of the art.  
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